DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMITTING and COMPLIANCE DIVISION
MONTANA GROUND WATER POLLUTION CONTROL SYSTEM (MGWPCS)

Fact Sheet/Statement of Basis

Permittee:	One Horse Acres LLC
Permit No.:	MTX000208
Receiving Water:	Class I ground water
Facility Information:	
Name	One Horse Estates Sewer System
Location	US Hwy 93 North Township 10N, Range 20W, Section 14 and 15, Ravalli County N 46° 37' 30", W 114° 05' 30"
Facility Contact:	Richard Martin, Vice President, One Horse Estates LLC 330 Martin Lane Florence, MT 59833 (406) 777-3025
Fee Information:	
Number of Outfalls	1
Outfall – Type	001 – Domestic Wastewater

I. Permit Status

The Department received an application for a new discharge to ground water from One Horse Acres, LLC on January 2, 2008. The applicant was notified by the Department of application deficiencies on January 14, 2008 and March 5, 2008. The Department determined the final application submittal as complete on June 9, 2008.

The discharge is a new source and is subject to nondegradation under Subchapter 7 – Nondegradation of Water Quality of the Administrative Rules of Montana (ARM) Title 17 Chapter 30.

This subdivision is pending approval under the Montana Sanitation in Subdivision Act (EQ #06-2387).

II. Facility Information

A. Facility Description

The applicant proposes to develop a 70-home subdivision south of Florence, located adjacent to and directly west of US Highway 93. Five phases of development are proposed. Phase one are larger lots that will each have its own septic tank and drainfield. Each home in phases two through five will have its own septic tank and wastewater will be treated at a community wastewater treatment facility. The application states that domestic wastewater will be treated using an AdvanTex system (Figure 1). From individual septic tanks, wastewater will gravity flow to two recirculation tanks where it will be pumped to one of six AdvanTex ax100 pods, where biological treatment occurs through fixed filter.

The design capacity of the system is 14,000 gallons per day (gpd) and 21,000 gpd, average and maximum respectively. Treated wastewater is pumped to a dose tank and discharged to ground water through an elevated sand mound drainfield that has six zones (Outfall 001). Discharge will be intermittent and metered continuously using a magnetic flow meter (as identified on the application).

Design information is summarized in Table 1.

Table 1: Design information One Horse Estates Sewer System (Ram Engineering, 2008)

Construction Date: proposed	Modification Date: NA
Design Households Served: - 70 single family residences	Population Served: 280
Design Flow, Average (gpd): 14,000	Design Flow, Peak (gpd): 21,000
Disinfection: none	Type: NA
Disposal Method: elevated sand mound	
Primary Effluent Flow Device: Siemens magnetic meter (“or approved equivalent”)	
Sludge Storage: none	
Sludge Disposal: NA	Permit Number: NA

B. Effluent Characteristics

This facility is a new discharge and has not been constructed. Data from this facility is not yet available. The applicant submitted estimated effluent quality data that are summarized in Table 2.

Table 2: Estimated Effluent Characteristics					
Parameter, units	**Units**	**Maximum value**	**Average value**	**Number of Samples**	**Source of Data**
pH, s.u.	s.u	8.5	6.0 [1]	---	3
Total Suspended Solids (TSS)	mg/L	25	10	---	3
Biochemical Oxygen Demand, (BOD_5)	mg/L	25	10	---	3
Oil and Grease	mg/L	5	<2	---	3
Chlorine, Total Residual (TRC)	mg/L	0	0	---	3
Escherichia Coli	CFU/100-mL	>2,000	<400	---	3
Total Ammonia as N	mg/L	8	5	---	3
Nitrite + Nitrate, as N	mg/L	20	16	---	3
Kjeldahl Nitrogen, as N	mg/L	12	8	---	3
Total Nitrogen [2]	mg/L	32	22	---	3
Total Phosphorous as P	mg/L	10	7	---	3
Total Dissolved Solids	mg/L	770	630	---	4
Specific Conductance	µS/cm	1,200	890	---	4
Chloride	mg/L	150	<100	---	3

1. For pH, the value shown for "average" is the minimum reported value.
2. Sum of nitrate + nitrite and total Kjeldahl nitrogen
3. Code provided in application for "data from other similar plants".
4. Code provided in application for "best professional estimate".

C. Compliance History

Because the facility is new and not yet constructed, a compliance evaluation or site inspection has not been completed.

III. Site Characteristics

The applicant proposes to discharge wastewater into the shallow alluvial aquifer. Information present by the Montana Bureau of Mines and Geology (MBMG; LaFave, 2006) indicates that the subdivision location is underlain by Quaternary sediments and that water is typically within 50 feet of the land surface. Nearby wells completed in the shallow unconfined aquifer indicate that ground water is about 19-37 feet below ground surface.

The application states ground water flow direction is reported as N 80° E. The MBMG report indicates that ground water in Sections 14 and 15 (the area of the proposed subdivision) may actually trend slightly south before trending along the azimuth supplied by the permittee. Regionally, the shall aquifer ground water moves towards the Bitterroot River, which is about two miles east of the subdivision (LaFave, 2006).

Ground water characteristics collected from one well over three separate calendar seasons was summarized in the permit application. Water quality samples were collected in November 2006, January 2008, and April 2008. These data are summarized in Table 3.

The maximum reported specific conductivity (SC) value is 165 µS/cm and the average is 160µS/cm (based on three samples). Four other wells where ground water quality samples have been collect show similar SC values (90-174 µS/cm; GWIC, 2008). Ground water that is less than 1,000 µS/cm at 25°C is classified as Class I ground water (ARM 17.30.1006). Class I ground waters must be maintained suitable for public and private water supplies, culinary and food processing, irrigation, commercial and industrial purposes, drinking water for livestock and wildlife, with little or no treatment. Human health standards listed in DEQ Circular 7 (February 2008) apply to concentrations of dissolved substances in Class I ground water.

The ground water in the vicinity of the discharge is considered high quality water pursuant to Montana's Nondegradation Policy. Degradation of high quality water is not allowed unless authorized by the Department under 75-5-303(3), MCA.

Table 3: Ground Water Characteristics

Parameter, units	Units	Minimum Value	Maximum Value	Average Value	No. of Samples	Source of Data
Specific Conductance	µS/cm	160	165	163	3	well
Total Dissolved Solids (TDS)	mg/L	96	708	301	3	Well
pH, s.u.	s.u.	6.48	7.02	6.79	3	Well
Chloride	mg/L	2.7	5.0	3.7	3	Well
Escherichia Coli	CFU/100-mL	<1	<1	<1	3	Well
Nitrite + Nitrate, as N	mg/L	0.86	1.16	1.04	3	Well
Kjeldahl Nitrogen, as N	mg/L	<0.22	0.24	<0.22	3	Well
Total Organic Carbon	mg/L	0.50	0.53	0.52	3	Well

Soil Characteristics

Site-specific soil information was provided to the Department as required for subdivision approval (Specialized Engineering, October 2006). Three test pits were dug, each pit touching at least one of the drainfield zones. The engineer notes describe four zones (A-D) and provide specific and general observations for the area. The top zone, Zone A, varied between nine to 18" deep and is described as a silty loam w/ 10% small gravel. Zone B is reported to be up to 23 inches deep below A (nine to 32 inches below ground surface). Zone B is described as a silty-sandy loam w/ 20% small gravel and dry with a few roots. Zone C extended from 32 to over 108 inches (nine feet) below ground surface. This zone is described as a sandy loam, "slightly moist", with 10% small gravels. Zone D is described as a sandy-gravelly loam and moist.

Notes from the engineer state that digging in the test pits ceased at a depth of 10 feet because "material appeared to be moist". However, comments state that ground water seepage was not realized. The summary states that the soils "seem to follow the USDA Soils map, however its quite apparent that the zones vary in thickness and are very wavy from one zone to the other". Notes from engineer specified that all zones were easy to dig.

Hydrology

The applicant stated two perennial streams are within a mile of the subdivision. One Horse Creek is reported as existing one-quarter mile to the north and Sweeney Creek is three-quarters of a mile to the south. Both surface waters are high quality waters.

United States Geological Survey (USGS) maps and aerial photos available through NRIS (2008) show wetland areas north of the subdivision around One Horse Creek and south of the subdivision and Section 14. Immediately north and south of the subdivision, the USGS map shows three small unnamed tributaries that drain from the west and meander east to the Bitterroot River near the proposed subdivision. One such drainage is shown on drainfield plan maps and is immediately north of the drainfield and mixing zone. Information submitted with the application state that this waterbody is an "irrigation ditch". The USGS map and design plan for the drainfield show the drainageway paralleling US Highway 93 and entering One Horse Creek. Using the applicant supplied ground water azimuth, the mixing zone does not intersect the drainage.

IV. Mixing Zone

The applicant applied for a standard mixing zone. A discharge that meets the nonsignificance criteria (ARM 17.30. subchapter 7) at the boundary of the mixing zone may qualify for a standard ground water mixing zone, as specified at ARM 17.30.517 (1)(c). In addition, the applicant must comply with the rules at ARM 17.30 Subchapter 5 and all applicable ground water standards at the defined down-gradient edge of the mixing zone. Ground water standards may be exceeded within the mixing zone provided that all existing and future beneficial uses of the state waters are protected (ARM 17.30.1005).

The Montana Water Quality Act requires that mixing zones be the smallest practicable size, have minimal effects on water uses, and have definable boundaries (MCA 75-5-301(4)). Standard ground water mixing zones are 500 feet long and 15 feet deep by rule (ARM 17.30.517). The lateral extent of the mixing zone is dependant on the width of the source (drainfield) plus the distance determined by the tangent of five degrees times the length, as stated at ARM 17.30.517(1)(d)(iii)(B). The application states the downgradient width is 342 feet.

Effluent limits for total nitrogen (TN) will be calculated using a mixing zone. The mixing zone dimensions and volume will be used in the phosphorus breakthrough analysis (refer to Section V. A). A mixing zone for pathogens, as monitored by *Escherichia coli* (*E. coli)* bacteria, is not granted.

The volume of the receiving water using for mixing is 32,000 feet/day and was calculated using Darcy's Law, as required at ARM 17.30.517(1)(d)(i). The equation for Darcy's law is given as Equation 1.

$Q = KIA$ **Equation 1**

Where: Q = ground water flow volume (ft^3/day)
K = hydraulic conductivity (ft/day)
I = hydraulic gradient (ft/ft)
A = cross-sectional area (ft^2) of flow at the down-gradient boundary

The applicant reported the hydraulic conductivity (K) as 259 ft/day and the hydraulic gradient (I) as 0.024 ft/ft. These values were recommended by the Department's Subdivision Section as documented in a letter to the applicant (and submitted with the discharge permit application). The recommended K value was from pump test data from an adjacent, recently approved subdivision. The I value came from a Unites States Geological Survey (USGS) Water Supply Paper (WSP) titled, "Geology and Water Resources of the Bitterroot Valley, Southwester Montana" (McMurtrey et al, 1972).

As stated above, the applicant reported the downgradient width of the mixing zone as 342 feet. This value is the sum of the width of drainfield perpendicular to flow (255 feet) and two times the tangent of 5° times the standard mixing zone length (500 feet; A = 255 feet + 2(tan 5°)(500 feet) = 342 feet). The cross-section area (A) is found by multiplying the downgradient width by the standard mixing zone depth (15 feet; A = 5,130 ft^2).

V. Proposed Discharge Limitations and Conditions

Permits are required to include effluent limits when the discharge quality does not meet state water quality standards. Montana water quality standards define both water use classifications for all state waters and numeric and narrative standards that protect those designated uses.

Water quality limitations must be established in permits to control all pollutant or pollutant parameters that are or may be discharged at a level which will cause, have reasonable potential to cause or contribute to an excursion above any state water quality standard. The permittee must comply with the permit developed by the Department in accordance with the Montana Numeric Water Quality Standards included in Circular DEQ-7 (February 2006) and protection of beneficial uses (ARM 17.30.1006). Ground water quality standards may be exceeded within a Department authorized mixing zone, provided that all existing and future beneficial uses of state waters are protected (ARM 17.30.1005).

Nondegradation Consideration

New sources, as defined in ARM 17.30.703(16), are subject to Montana Nondegradation Policy (75-5-303, MCA) and regulations (ARM 17.30.701-718, "Nondegradation of Water Quality"). ARM 17.30.702 defines "new or increased source" as an activity resulting in a change of existing water quality occurring on or after April 29, 1993. Outfall 001 is a new source for the purposes of nondegradation. Effluent quality of Outfall 001 is subject to a nonsignificance review.

The Department review of proposals for new or increased sources will determine the level of protection required for the receiving water, based on: a) existing and anticipated used and the

water quality necessary to protect and maintain those uses; and b) degradation that may be allowed only according to the procedures in ARM 17.30.708. These rules apply to any activity that may cause degradation of high quality waters, for any parameter, unless the changes in existing water quality resulting from the activity are determined to be nonsignificant under ARM 17.30.715 or 17.30.716.

ARM 17.30.715 states criteria that are used to determine nonsignificance. These criteria consider the quality and strength of the pollutant, the length of time the changes will occur, and the character of the pollutant. Pollutants that are present in domestic wastewater that will be subject, but are not limited to, nonsignificance review are nutrients (TN and Total Phosphorus, TP).

A. Calculated Effluent Quality

Pollutants typically present in domestic-strength effluent that may exceed water quality standards include: pathogens, as measured by *Escherichia coli* (*E. coli*) bacteria; and nutrients, including nitrate plus nitrite as nitrogen (N) and TP.

Escherichia coli (*E. coli*) Bacteria – A wastewater treatment system that is appropriately sited and operating properly should remove most if not all of the pathogenic bacterial indicators within 2 to 3 feet of the drainfields infiltrative surface (USEPA, 2002).

An *Escherichia coli* (*E coli*) effluent limit is not been established in this permit due to the following site-specific criteria:

- The drainfield is pressured-dosed, which minimizes saturated conditions and therefore maximizes the die-off rate in the natural sediments.
- The soils series, Sheafamn-Victor complex, is relatively well drained (NRCS, 2008). Higher oxygen conditions in soil allow for more rapid reoxygenation between dose rest cycles and the potential for the soils to more quickly treat wastewater.

Total Nitrogen – As a conservative approach, the Department assumes that all forms of nitrogen (organic and inorganic – i.e. nitrate, nitrite, and ammonia as N) discharged by the system are converted to nitrate as N through treatment, in the drainfield, and beyond. Effluent limits are stated as TN.

The Department employs two methods in analyzing discharged TN to the receiving water. Based on the results of the two methods, the more restrictive value is applied as the effluent limit. The methods of analysis are based on: 1) level of treatment; or 2) nonsignificance determination.

Level of Treatment

The Orenco Systems AndvanTex wastewater treatment system, when properly installed, operated, and maintained, is recognized by the Department as meeting Level II treatment, as defined at ARM 17.30.702(11). Level II treatment systems provide a higher degree of treatment than a conventional wastewater treatment system. A Level II system must provide at least 60%

removal of the TN in the raw wastewater or discharge a total nitrogen effluent concentration of 24 mg/L or less.

Because this system has individual septic tanks, a representative removal (percentage) of total nitrogen through treatment cannot be realistically estimated. Therefore, the effluent quality is assumed to be 24 mg/l total N. The drainfield provides additional treatment; an assumed additional 7% of nitrogen removal occurs within the drainfield. The proposed limit based on the approved level of treatment is 26 mg/L.

Nonsignficance Determination

ARM 17.30.715 sets forth the criteria by which a new or increased source must be compared and determined nonsignificant. To be nonsignificant, a ground water discharge must meet 7.5 mg/L or less TN at the edge of the mixing zone.

A mass-balance approach (Equation 2) is used to calculate the effluent total N quality that can be discharged to meet the nonsignificance criteria.

$$C_E = \frac{C_{stnd}(Q_{GW} + Q_E) - Q_{GW}C_{GW}}{Q_E} \quad \textbf{Equation 2}$$

Where: C_E = calculated effluent value
C_{stnd} = 7.5 mg/L total N (ARM 17.30.715)
Q_{GW} = 32,000 ft^3/day (calculated, Part IV. Mixing Zone)
Q_E = 2,800 ft^3/day (21,000 gpd = max. design discharge, application)
C_{GW} = 1.40 mg/L (ave. upgradient total N concentration, application)

From Equation 2, a calculated TN effluent value of 77 mg/L would meet the nonsignificance criteria of 7.5 mg/L at the end of the mixing zone.

Proposed Nitrogen Limit

The total N effluent limit is 26 mg/L based on the lower resultant from the two described methods. This value is an instantaneous limit, based on rule, that the effluent quality will always be less than 24 mg/L TN to be considered nonsignificant (AMR 17.30.702)

Total Phosphorus (TP) – Phosphorus is primarily removed from discharge effluent through soil adsorption, which is slow and varies with soil composition.

Total phosphorus (TP) limits are imposed to ground water discharges to ensure that effluent quality is nonsignificant prior to a discharge (break-through) into any surface water (ARM 17.30.715(1)(e)). TP limits are based on total load, not concentration. Effluent limits are calculated based on a 50-year breakthrough and are dependant on the amount of phosphorus the soil can adsorb.

The nearest downgradient surface water is an unnamed intermittent tributary, which is approximately 2,300 feet downgradient of the northeast corner of the drainfield based on the

ground water azimuth supplied (N 80° E). The distance was determined using the drainfield location supplied by the permittee and scaling on the USGS Stevensville 7.5 minute quadrangle (USGS, 1967). Aerial photography was used to determine that the drainage way exists today and appears to have at least a seasonal connection to ground water (defined channel, established trees, green edges; NRIS 2008).

Attachment 1 shows the values used in the Department's phosphorus break-through analysis. Based on constant and site specific values, the break-through time calculated is 61 years. The resulting load, using design and conservative assumptions for TP in the subsurface, is 1.2 lbs/day (450.8 lbs/year). An effluent limit for TP is not necessary because the break-through analysis shows that the discharge should not impact surface water quality.

Effluent and downgradient ground water quality monitoring for TP will be required.

BOD and TSS – The application states that the proposed wastewater treatment system will remove 95% of Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS). Most solids are settled and removed in the septic tanks during pretreatment. Colloidal and dissolved BOD that might pass through the media is removed through aerobic biological processes in the vadose zone, especially when uniform dosing and reoxygenation occur. If excessive concentration of BOD and TSS migrate beyond the tank because of poor maintenance, the infiltrative surface can clog and surface seepage of wastewater or plumbing fixture backup can occur (EPA, 2002).

Effluent monitoring for BOD and TSS is required, but a limit for these parameters is not applicable. These parameters are not subject to nondegradation unless they have a reasonable potential to affect a beneficial use. The significance criteria for BOD, TSS are narrative [ARM 17.30.715 (1)(g)].

B. Proposed Final Limits

Proposed Final Effluent Limits		
Parameter	Effluent Limitations	
	Daily Maximum [1] (mg/L)	90-day Average [1]
Total Nitrogen as N	26.0	NA
1. See definitions, Part V. of the permit		

VI. Monitoring Requirements

A. Influent Monitoring

Not applicable at this time. Each home has its own septic tank; therefore, the wastewater coming into the plant is not truly “raw” wastewater (each septic tank provides primary treatment).

B. Effluent Monitoring

Effluent quality and ground water quality monitoring will be required by the permit. MGWPCS permits are required to contain conditions to ensure compliance with the ground water quality standards. These conditions include self monitoring of discharge, as required at ARM 17.30.1031(5). Effluent quality samples or measurements shall be representative of the volume and nature of the monitored discharge. Water quality samples will be collected from an access port in the dose tank prior to discharge into the drainfield (Figure 1).

Effective upon issuance, the permittee is required to monitor the volume and quality of the wastewater discharged to Outfall 001 for the parameters stated (Table 4). If no discharge occurs during the entire monitoring period, it shall be stated in a Discharge Monitoring Report (DMR) that no discharge occurred.

The permittee is required monitor effluent flow continuously and report the average daily flow in gallons per day. Average daily flow measurements are required to coincide with water quality sample collection for load calculations. The effluent flow measurement method shall be either by flow meter and recorder or a totalizing flow meter; dose counts or pump run-times will not be accepted. Flow measurement equipment must have the ability to report an average daily flow.

Table 4: Effluent Monitoring Requirements			
Parameter	Unit	Sample Frequency	Sample Type[1]
Flow	gpd	Continuous	Instantaneous [2]
pH	s.u.	1/Month	Instantaneous
Specific Conductivity	µS/cm	1/Month	Instantaneous
5-Day Biological Oxygen Demand (BOD_5)	mg/L	1/Quarter	Composite
Total Suspended Solids (TSS)	mg/L	1/Quarter	Composite
E. coli	No./100ml	1/Month	Grab
Oil and Grease [3]	mg/L	1/Quarter	Grab
Total Ammonia, as N	mg/L	1/Month	Composite
Nitrate + Nitrite, as N	mg/L	1/Month	Composite
Kjeldahl Nitrogen, Total, as N	mg/L	1/Quarter	Composite
Total Nitrogen, as N [4]	mg/L	1/Quarter	Calculated
	lbs/day	1/Quarter	Calculated
Total Phosphorus, as P	mg/L	1/Quarter	Grab
	lbs/day	1/Quarter	Calculated

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. Requires recording device or totalizer; permittee shall report daily maximum and daily average flow on DMR.
3. Use EPA Method 1664, Revision A: N-Hexane Extractable Material (HEM), or equivalent.
4. Calculated as the sum of Nitrate + Nitrite (as N) and Total Kjeldahl Nitrogen (as N) concentrations.

VII. Nonsignificance Determination

The Department has determined the proposed discharge is nonsignificant and there will be no degradation of state waters [Montana Nondegradation Policy [75-5-303, MCA; ARM 17.30.702(16)]. The nonsignificance confines were placed on analyses used to determine total N and total P effluent limits. The effluent limits for total N and TP are based on compliance with water quality standards and meet the nonsignificance criteria. The proposed total N discharge limit was calculated so as to restrict an exceedance of total N at the hydraulically downgradient boundary of the 500-foot standard ground water mixing zone. The TP limit will not allow a break-through to surface water of inorganic P in less than 50 years.

VIII. Special Conditions

A. Monitoring Well Installation

By September 1, 2009, the applicant is required to install at least one monitoring well located on the centerline of the perceived downgradient boundary of the standard mixing zone. In addition, the well is required to be:

1. Screened from the top of the high water table to 15 feet below the low water table;

2. On subdivision property and always accessible to wastewater personnel to assure continued accessibility for monitoring purposes; and
3. Installed by a licensed monitoring well constructor.

The permittee will retain a copy of the completed well for submittal to the Department.

By December 31, 2009, the permittee must submit a brief report or letter to the Water Protection Bureau documenting the results of the monitoring well installation including the final location of the installed monitoring wells, construction details for the well and a report on the initial ground water quality in the from the wells.

B. Ground Water Monitoring

This area is experiencing rapid growth with high density development and increased sources of domestic wastewater discharge to the ground water (both individual and community systems). Several domestic wells exist down-gradient of the proposed discharge. The proposed subdivision is relatively near the Bitterroot River, a 303(d) listed stream impaired by, in part, nutrients (nitrogen and phosphorus). Because of these reasons, ground water monitoring is required by the permit to:

- Monitor the effects to ground water from the discharge of treated domestic wastewater from the proposed system;
- Ensure that ground water quality standards are met at the end of the Department authorized mixing zone;
- Ensure that existing and future beneficial uses are protected

The permittee will conduct quarterly monitoring for the parameters listed in Table 5 effective September 1, 2009.

Table 5: Monitoring Parameters for Monitoring Wells

Parameter	Unit	Frequency	Sample Type (1)
Static Water Level (SWL; feet below top of casing)	Feet	Quarterly	Instantaneous
Specific Conductance	µS/cm	Quarterly	Instantaneous
Chloride	mg/L	Quarterly	Grab
E. Coli Bacteria	CFU/100 mL	Quarterly	Grab
Total Ammonia, as N	mg/L	Quarterly	Grab
Nitrate + Nitrite as N	mg/L	Quarterly	Grab
Total Nitrogen	mg/L	Quarterly	Grab
Total Phosphorus, as P,	mg/L	Quarterly	Grab

1. See definitions, Part V. of this permit

In addition to monitoring well installation and initiation of sampling, the permittee must also establish a Standard Operating Procedure (SOP) and Sampling and Analysis Plan (SAP) to address ground water monitoring. By **September 1, 2009**, the permittee shall develop and maintain a copy of a SOP and SAP. At a minimum, the SOP and SAP should address:

- well purging;
- equipment and procedures used for sample collection or field parameter measurement;
- sample collection, specifying sampling equipment and procedures;
- equipment decontamination procedures and storage;
- sample preservation and storage; and
- sample transport to the contract lab.

IX. Information Source

Montana Statute, "Montana Water Quality Act", Title 75-5-101-605, Montana Code Annotated (MCA).

Administrative Rule of Montana (ARM) at:

- Subchapter 5: Mixing Zones in Surface and Ground Water. March 2006
- Subchapter 6: Montana Surface Water Quality Standards. March 2006.
- Subchapter 7: Nondegradation of Water Quality. March 2006.

DEQ. Circular 7 Montana Numeric Water Quality Standards. February 2008.

GWIC (Ground Water Information Center). Website: http://mbmggwic.mtech.edu/, accessed December 5, 2008.

Lafave, John I. Potentiometric Surface of the Shallow Basin Fill, Deep Basin-Fill, and Bedrock Aquifers, Bitterroot Valley, Missoula and Ravalli Counties, Western Montana. 2006. Montana Bureau of Mines and Geology (MBMG). GWAA 4B-08.

McMurtrey, R. G., Konizeski, R. L., Johnson, M. V., and Bartells, J. H. "Geology and Water Resources of the Bitterroot Valley, Southwestern Montana". Geological Survey Water-Supply Paper 1889. United States Government Printing Office, 1972.

NRCS (Natural Resource Conservation Service) Web Soil Survey (WSS). Website: http://websoilsurvey.nrcs.usda.gov/app/, accessed December 15, 2008.

NRIS (Natural Resource Information System). Website: http://nris.mt.gov/default.asp, accessed December 5, 2008.

Ram Engineering. 2008. Engineering plans supplied with permit application.

Specialized Engineering. 2006. Soil Pit Logs, certified by Howard R. Anderson, PE (Specialized Engineering), October 2006. Submitted to the Department August 18, 2008.

USGS (Untied States Geological Survey) 7.5 minute quadrangle maps – Florence and Stevensville quads. 1967

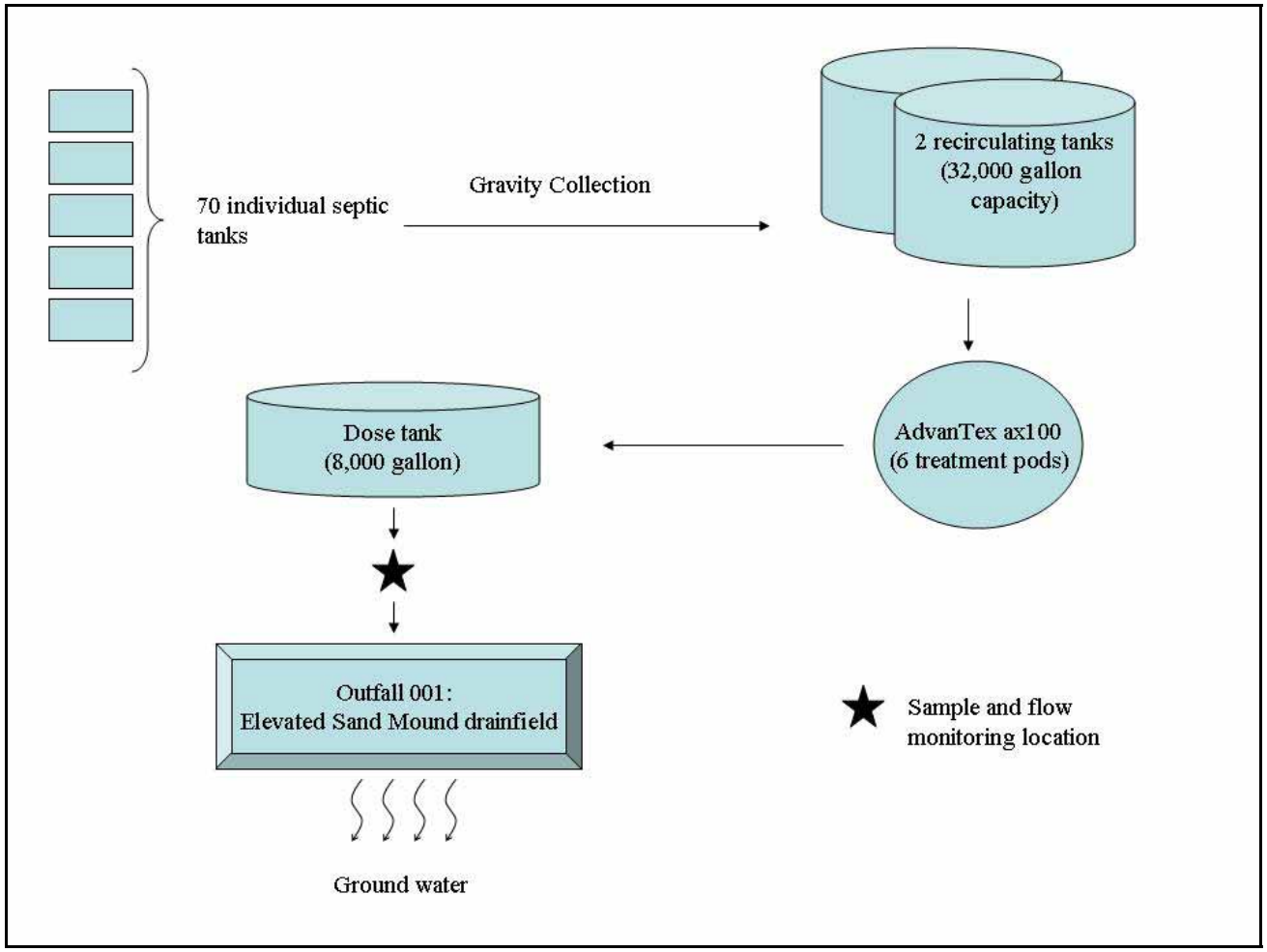

Figure 1 – Facility flow diagram.

Prepared by: Rebecca Ridenour
Date: January 12, 2009

Attachment 1 – Total Phosphorus Break Through Calculations

VARIABLES	DESCRIPTION	VALUE	UNITS	NOTES
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	255.0	ft	from application, pg. 6, Sec.L
L	Length of Primary Drainfield's Long Axis	272.0	ft	from plans submitted w/ application
W	Width of Primary Drainfield's Short Axis	75.0	ft	"
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	6.0	ft	from applicant
D	Distance from Drainfield to Surface Water	2600.0	ft	Using USGS 7.5 topo map (Stevensville, 1967), Lat/Long from form 1, and azm. of GW
T Ne	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	1.0	ft	in application materials, site sp. soil is classified as "loams" = fine soil based on **
Sw	Soil Weight (usually constant)	100.0	lb/ft3	
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200.0	ppm	
#l	Number of Single Family Homes on the Drainfield	70.0		
CONSTANTS				
Pl	Phosphorous Load per Single Family Home (constant)	6.44	lbs/yr	constant
X	Conversion Factor for ppm to percentage (constant)	1.0E+06		constant
EQUATIONS				
Pt	Total Phosphorous Load = (Pl)(#l)	450.80	lbs/yr	
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	1.2E+07	lbs	
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	1.3E+08	lbs	
P	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	2.8E+04	lbs	
SOLUTION				
BT	**Breakthrough Time to Surface Water = P / Pt**	61.1	years	

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*
*** Material type is usually based on test pit. A soil that can be described as loam (e.g. gravelly loam, sandy loam, etc.) or finer according to the USDA soil texture classification system is considered a "fine" soil.*